<u>REMARKS</u>

Claims 1-82 remain pending in the Application, of which claims 1, 10, 16, 20, 29, 35, 44, 50, 59, 65, and 74 are in independent form. Claims 50-64 have been amended. No new matter has been added. Applicant respectfully requests reconsideration in view of the foregoing amendments and the following remarks.

I.   Allowable Subject Matter

Applicant thanks the Examiner for indicating that claims 3, 4, 5, 8, 12-15, 17-18, 22-23, 27, 31-33, 37-39, 42, 46-49, 67-71, and 76-80 are merely objected to as being dependent on a rejected base claim but would be allowable if rewritten in independent form.

II.   Claim Rejections under 35 U.S.C. § 101

The Examiner rejected claims 50-64 under 35 U.S.C. § 101(a) as being directed to a computer program. Although Applicant maintains that these claims were allowable as written, Applicant has amended the claims in response to the Examiner's statements in an effort to expedite prosecution. Therefore, Applicant respectfully requests examination and allowance of claims 50-64.

III.   Claim Rejections under 35 U.S.C. § 103

The Examiner rejected claims 1-2, 6-7, 9-11, 16, 19, 20-21, 25-26, 28, 29-30, 34, 35-36, 40-41, 43, 44-45, 50-51, 55-56, 58, 59-60, 65-66, 72-73, 74-75, and 81-82 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Publication No. 2004/0190636 ("Oprea") in view of U.S. Publication No. 2003/0016621 ("Li"). Applicant respectfully traverses these rejections.

a.   Claim 1 and its dependent claims

Claim 1 is directed to a method that includes transmitting a first training symbol on a plurality of antennas. The first training symbol comprises a plurality of data symbols, and each of the plurality of data symbols corresponds to different ones of a plurality of tones. Each of the plurality of antennas transmits a corresponding one of the plurality of data symbols.

Oprea shows a wireless communication system for transmitting input data symbol sub-streams over spatial-subspace channels of a sub-carrier frequency. (Abstract). Each input data symbol corresponds to a group of input data bits. (Para. [0036]). The transmitter divides the

input data symbol streams among separate "super-frames" of data. (Abstract; para. [109]; Fig. 6A). The transmitter then inserts training symbols for the corresponding subspace into each super-frame, such that each super-frame contains multiple data symbols, a training and/or synchronization symbol, and a channel and transmission information ("CTI") symbol. (Para. [109]; Fig. 6A). The transmitter then transmits the super-frames across a channel to a receiver. (Para. [0037].)

Oprea fails to teach or suggest, at least, <u>transmitting a first training symbol on a plurality of antennas, wherein the first training symbol comprises a plurality of data symbols</u>. Oprea's transmitter takes an input stream of data symbols and divides the data symbols among various super-frames. (Para. [109]). Oprea's transmitter inserts training/synchronization and CTI symbols into each super-frame. (Id.). These super-frames are then transmitted to a receiver. (Para. [0037]). Oprea does not show transmitting a single training symbol that is composed of a plurality of data symbols. Rather, Oprea shows transmitting multiple super-frames that have been spliced with training and CTI symbols, where each super-frame contains numerous data symbols. (Paras. [0036], [0109]). Oprea's data symbols are not and do not comprise Applicant's claimed training symbol: rather, each data symbol corresponds to bits of real-world input data. (Para. [0036]). Li does not cure this deficiency. Applicant respectfully submits that claim 1 is allowable over the asserted combination of Oprea and Li for at least these reasons.

In addition, the Examiner acknowledges that Oprea fails to teach or suggest that <u>each </u>of Applicant's claimed <u>data symbols corresponds to different ones of a plurality of tones</u>. The Examiner suggests, instead, that Li shows this limitation in paragraphs 27 and 28, which are reproduced here below:

[0026] From Eq. (1), the frequency response H(t,f) of a communication channel at time t can be described by Eq. (2):

$$H(t, f) \triangleq \int_{-\infty}^{+\infty} h(t, \tau)\exp(-j2\pi f\tau)d\tau \tag{2}$$

or

$$\triangleq C(f)\sum_{k} \gamma_k(t)\exp(-j2\pi f\tau_k) \tag{3}$$

where

$$C(f) \triangleq \int^{+\infty} c(\tau)\exp(-j2\pi f\tau_k). \tag{4}$$

[0027] For OFDM systems with proper cyclic extension and timing, the channel frequency response can be expressed by Eq.(5):

$$H[n, k] \triangleq H(nT_f, k\Delta f) = \sum_{t=0}^{K_o-1} h[n, l]W_K^{kl}, \tag{5}$$

The portions of Li relied on by the Examiner do not disclose a plurality of data symbols corresponding to different ones of a plurality of tones – these passages merely present the basic equation for the channel frequency response of OFDM systems. (Paras. [0027]-[0028]). Applicant respectfully asserts that the portions of Li relied upon provide no indication that Li's symbols correspond to different ones of a plurality of tones. Applicant respectfully submits that claim 1 is allowable over the asserted combination of Oprea and Li for at least these additional reasons.

Claims 2, 6-7, and 9 depend from claim 1, and are allowable for at least the reasons set forth above with respect to claim 1.

Claim 6 is also separately allowable for at least the following additional reasons. Claim 6 recites transmitting the first training symbol at least two times. The Examiner relies on para. [0052] of Oprea, "wherein the training symbols are periodically transmitted to the receiver," as allegedly meeting this limitation. Applicant respectfully submits that claim 6 recites transmitting the *first* training symbol, i.e., transmitting the *same* training symbol, at least twice. Oprea states

only that "[t]raining symbols are periodically generated and transmitted to the receiver 16 for periodically estimating the channel matrix H_k for each sub-carrier k." Nothing in Opera suggests that precisely the same training symbol is transmitted at least two times. Applicant respectfully submits that claim 6 is separately allowable over the asserted combination of Oprea and Li for at least these additional reasons.

Claim 7 is also separately allowable for at least the following additional reasons. Claim 7 recites that <u>the plurality of data symbols in the first training symbol are transmitted simultaneously on the plurality of antennas</u>. The Examiner relies, without further explanation, on para. [0037] of Oprea as allegedly meeting this limitation. However, para. [0037] of Oprea says only that "[t]he OFDM data symbol waveforms are transmitted to the receiver antenna array 18 of the receiver 16 via a communications channel that comprises a plurality of signal paths for each OFDM sub-carrier k." In the first place, as discussed above, Oprea does not show a <u>plurality of data symbols in the first training symbol</u> – Oprea shows a super-frame containing multiple data symbols, with training and CTI symbols periodically inserted within. (Paras. [0036], [0109]). Additionally, nothing in Oprea suggests that the training symbols are <u>transmitted simultaneously on the plurality of antennas</u>. Applicant respectfully asserts that Oprea's training symbols would not be transmitted simultaneously: each training symbol corresponds to a particular sub-stream, and the symbols are "inserted in one spatial-subspace channel at a time." (Paras. [0036], [0053]). Applicant respectfully submits that claim 7 is separately allowable over the asserted combination of Oprea and Li for at least these additional reasons.

b. Claim 10 and its dependent claims

Claim 10 is directed to a method that includes receiving a first training symbol transmitted by a plurality of antennas. The first training symbol includes a plurality of data symbols and each of the plurality of data symbols corresponds to different ones of a plurality of tones. Each of the plurality of data symbols is received from a corresponding one of the plurality of antennas. In response to at least the first training symbol, a gain is determined at each of the plurality of antennas for each of the plurality of tones.

Claim 10 is allowable for at least the reasons set forth above with respect to claim 1.

Claim 10 is also separately allowable for at least the following additional reasons. Claim 10 recites that <u>in response to at least the first training symbol, a gain is determined at each of the plurality of antennas for each of the plurality of tones</u>. The Examiner relies, without further explanation, on para. [0067] of Oprea as allegedly meeting this limitation. However, the cited section of Oprea merely states that it may be possible to "further process" the matrix A_k (representing the channel quality for each spatial-subspace channel) by applying "the partial SVD algorithm" (defining the interaction of each transmitter antenna with each receiver antenna). (Paras. [0005], [0043], [0052]). Nothing in Oprea suggests that <u>a gain is determined at each of the plurality of antennas for each of the plurality of tones</u>. Applicant respectfully submits that claim 10 is separately allowable for at least these additional reasons.

Claim 11 depends from claim 10, and is allowable for at least the reasons set forth above with respect to claim 10.

a. Claim 16 and its dependent claims

Claim 16 is directed to a preamble structure including a first training symbol having a plurality of data symbols. Each of the plurality of data symbols corresponds to different ones of a plurality of tones. Each of a plurality of subsets of the plurality of data symbols is designated to be transmitted by a corresponding one of a plurality of antennas.

Claim 16 is allowable for at least the reasons set forth above with respect to claim 1.

Claim 19 depends from claim 16 and is allowable for at least the reasons set forth above with respect to claim 16.

b. Claim 20 and its dependent claims

Claim 20 is directed to an apparatus including a training module that transmits a first training symbol on a plurality of antennas. The first training symbol includes a plurality of data symbols, and each of the plurality of data symbols corresponds to different ones of a plurality of tones. Each of the plurality of antennas transmits a corresponding one of the plurality of data symbols.

Claim 20 is allowable for at least the reasons set forth above with respect to claim 1.

Claims 21, 25-26, and 28 depend from claim 20 and are allowable for at least the reasons set forth above with respect to claim 20.

Claim 25 is also separately allowable for at least the reasons set forth above with respect to claim 6.

Claim 26 is also separately allowable for at least the reasons set forth above with respect to claim 7.

c. Claim 29 and its dependent claims

Claim 29 as amended is directed to an apparatus including a training module that receives a first training symbol transmitted by a plurality of antennas. The first training symbol includes a plurality of data symbols, and each of the plurality of data symbols corresponds to different ones of a plurality of tones. Each of a plurality of subsets of the plurality of data symbols is received from a corresponding one of the plurality of antennas. In response to at least the first training symbol, a gain is determined at each of the plurality of antennas for each of the plurality of tones.

Claim 29 is allowable for at least the reasons set forth above with respect to claim 10.

Claims 30 and 34 depend from claim 29 and are allowable for at least the same reasons set forth above with respect to claim 29.

d. Claim 35 and its dependent claims

Claim 35 is directed to an apparatus that includes means for transmitting a first training symbol on a plurality of antennas. The first training symbol comprises a plurality of data symbols, and each of the plurality of data symbols corresponds to different ones of a plurality of tones. Each of the plurality of antennas transmits a corresponding one of the plurality of data symbols.

Claim 35 is allowable for at least the reasons set forth above with respect to claim 1.

Claims 36, 40-41, and 43 depend from claim 35 and are allowable for at least the reasons set forth above with respect to claim 35.

Claim 40 is also separately allowable for at least the reasons set forth above with respect to claim 6.

Claim 41 is also separately allowable for at least the reasons set forth above with respect to claim 7.

e. Claim 44 and its dependent claims

Claim 44 is directed to an apparatus that includes means for receiving a first training symbol transmitted by a plurality of antennas and means for determining a gain at each of the plurality of antennas for each of a plurality of tones in response to at least the first training symbol. The first training symbol comprises a plurality of data symbols, and each of the plurality of data symbols corresponds to different ones of a plurality of tones. Each of the plurality of data symbols is received from a corresponding one of the plurality of antennas.

Claim 44 is allowable for at least the reasons set forth above with respect to claim 10.

Claim 45 depends from claim 44 and is allowable for at least the reasons set forth above with respect to claim 44.

f. Claim 50 and its dependent claims

Claim 50 is directed to a computer program for transmitting a first training symbol on a plurality of antennas. The first training symbol includes a plurality of data symbols, and each of the plurality of data symbols corresponds to different ones of a plurality of tones. Each of the plurality of antennas transmits a corresponding one of the plurality of data symbols.

Claim 50 is allowable for at least the reasons set forth above with respect to claim 1.

Claims 51, 55-56, and 58 depend from claim 50 and are allowable for at least the reasons set forth above with respect to claim 50.

Claim 55 is also separately allowable for at least the reasons set forth above with respect to claim 6.

Claim 56 is also separately allowable for at least the reasons set forth above with respect to claim 7.

g. Claim 59 and its dependent claims

Claim 59 is directed to a computer program for receiving a first training symbol transmitted by a plurality of antennas and determining a gain at each of the plurality of antennas for each of a plurality of tones in response to at least the first training symbol. The first training

symbol includes a plurality of data symbols, and each of the plurality of data symbols corresponds to different ones of a plurality of tones. Each of a plurality of subsets of the plurality of data symbols is received from a corresponding one of the plurality of antennas.

Claim 59 is allowable for at least the reasons set forth above with respect to claim 10.

Claim 60 depends from claim 59 and is allowable for at least the reasons set forth above with respect to claim 59.

h. Claim 65 and its dependent claims

Claim 65 is directed to a system including first and second transceivers. The first transceiver includes a first plurality of antennas and a transmit training module to transmit a first training symbol on the first plurality of antennas. The first training symbol comprises a plurality of data symbols, and each of the plurality of data symbols corresponds to different ones of a plurality of tones. Each of the first plurality of antennas transmits a corresponding one of the plurality of data symbols. The second transceiver includes a second plurality of antennas and a receive training module. The receive training module receives the first training symbol and determines a gain at each of the first plurality of antennas for each of the plurality of tones in response to at least the first training symbol.

Claim 65 is allowable for at least the reasons set forth above with respect to claim 1.

Claims 66 and 72-73 depend from claim 65 and are allowable for at least the reasons set forth above with respect to claim 65.

i. Claim 74 and its dependent claims

Claim 74 is directed to a system including first and second transceivers. The first transceiver includes a first plurality of antennas and means for transmitting a first training symbol on the first plurality of antennas. The first training symbol comprises a plurality of data symbols, and each of the plurality of data symbols corresponds to different ones of a plurality of tones. Each of the first plurality of antennas transmits a corresponding one of the plurality of data symbols. The second transceiver includes a second plurality of antennas, means for receiving the first training symbol, and means for determining a gain at each of the first plurality of antennas for each of the plurality of tones in response to at least the first training symbol.

Claim 74 is allowable for at least the reasons set forth above with respect to claim 10.

Claims 74-75 and 81-82 depend from claim 74 and are allowable for at least the reasons set forth above with respect to claim 74.

IV.   Conclusion

By responding in the foregoing remarks only to particular positions taken by the Examiner, Applicant does not acquiesce to other positions that have not been explicitly addressed. Additionally, Applicant's arguments for the patentability of a claim should not be understood as implying that no other reasons for the patentability of that claim exist.

No fees are believed to be due at this time. Please apply any other charges or credits to deposit account 06-1050.

Respectfully submitted,

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